

## Myocardial Protection

*At the heart of the Protection*



*Dedicated solutions for all of the different myocardial protection methods.*

*A wide collection of crystalloid, cold and warm blood cardioplegia systems available for delivering your myocardial protection.*

# 1. Cold Crystalloid Cardioplegia

Developed in the mid -1960s, cold crystalloid cardioplegia<sup>1</sup> represented a key milestone in open heart surgery, providing a simple but effective way of protecting the heart: hypothermia. In many institutions around the world, cold crystalloid cardioplegia remains in use as a method of myocardial protection.

LivaNova offers several sets for general use, and customizes sets upon request.

1. H. Geissler, U. Mehlhorn "Cold Crystalloid Cardiopneuma", multimedia Cardio Thoracic Surgery volume 2006, Issue 0109.

### Order Guide

| Item Number | Product Designation                              | Units per box |
|-------------|--------------------------------------------------|---------------|
| AB1610      | D500 – Basic Clear Cardioplegia Delivery Set     | 10            |
| AB1611      | D505 – Optimized Clear Cardioplegia Delivery Set | 2             |

# 2. Blood Cardioplegia

Developed as an evolution of cold crystalloid cardioplegia, blood cardioplegia (cold or warm) provides the following benefits:

- Improved oxygen carrying capacity and delivery
- Enhanced myocardial oxygen consumption
- Preserved high-energy phosphate stores
- Buffering changes in pH
- Provides appropriate osmotic environment for myocardial cells and lessens the myocardial oedema

|                               | Oxygen Demand    | Reduction <sup>2</sup> |
|-------------------------------|------------------|------------------------|
| Normothermic Arrest (37°C)    | 1ml/100g/min     | 90%                    |
| Hypothermic Arrest (22°C) Set | 0.30 ml/100g/min | 97%                    |
| Hypothermic Arrest (10°C)Set  | 0.14 ml/100g/min | ~97%                   |

## 2.1. Warm Blood Cardioplegia with Bubble Trap

The D725 Warm Blood Cardioplegia delivery set has been developed in response to the Modern Protocols targeting myocardial protection by lowering the oxygen consumption due to chemical stop (~90% in normothermia)<sup>2</sup>.



*BCD Bubble Trap*

The dedicated BCD Vanguard™ bubble trap improves safety for the patient ameliorating the air handling. The BCD Vanguard bubble trap includes a 105 µm screen filters. Its special geometry filters and directs bubbles up and out of the device through a hydrophobic membrane and a one-way valve. The result is enhanced safety and the convenience of one step priming. A pressure relief valve (> +400 mmHg) prevents any damage generated by occlusion of the table line.

2. GD Buckberg, JR Brazier and RL Nelson et al., Studies of the effects of hypothermia in regional blood flow and metabolism during cardiopulmonary bypass, J Thorac Cardiovasc Surg 73 (1977), pp. 87-94.

### Technical Features

|                                              |                                                    |
|----------------------------------------------|----------------------------------------------------|
| Connections                                  | 3/16" (inlet & outlet)                             |
| Static Priming Volume - BCD bubble trap only | 23 ml                                              |
| Static Priming Volume - D725 circuit         | 130 ml                                             |
| Air Handling                                 | - integrated bubble trap<br>- 105 µm filter screen |
| Max Blood Flow                               | 500 ml/min                                         |

### Order Guide

| Item Number | Product Designation                       | Units per box |
|-------------|-------------------------------------------|---------------|
| 05095       | D725 Warm Blood Cardioplegia Delivery Set | 15            |

## 2.2. Cold Blood Cardioplegia: CSC and Vanguard

When the combination of hypothermia security and optimum oxygen delivery are needed, cold blood cardioplegia is the response. LivaNova offers a wide range of different stainless steel heat exchangers to fully meet your needs.

### > CSC 14



#### The Visible Solution

Total visibility design is a common concept in the LivaNova ECC offering. The clear fluid pathways increase the possibility for overall visible monitoring by perfusionists, thereby enhancing safety during the extracorporeal perfusion. Like LivaNova oxygenators, the LivaNova Venous and Cardiotomy Reservoirs as well as the LivaNova Arterial Filters, the LivaNova Cardioplegia Heat Exchangers are designed with this philosophy in mind: the visible solution.

#### Great performance

The CSC 14 Heat Exchanger is designed to have an extremely high performance factor for single pass perfusion both for blood cardioplegia and crystalloid deliveries.

#### Efficient and quick preparation

The priming and debubbling of CSC 14 is very quick and easy, enhanced by the integrated priming dial and complete visibility of the fluid pathway.

#### Integrated Bubble Trap

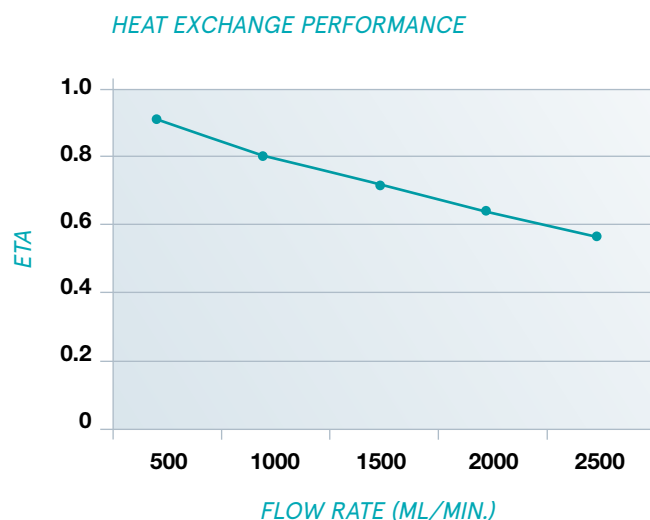
An air separation screen creates a highly efficient bubble trap, minimizing the risk of air bubble delivery.

#### Unique Reversible Holder

The holder allows right or left pump set-up and is affixed from the back side of CSC 14, maintaining easy access and full visibility.

#### Flexibility and Versatility

CSC 14 is available separate or integrated in standard cardioplegia sets.



### Technical Features

|                                     |                                                                                                                                |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Connections                         | <ul style="list-style-type: none"> <li>- 1/4" Blood inlet</li> <li>- 1/4" Blood Outlet</li> <li>- 1/2" Hansen Quick</li> </ul> |
| Static Priming Volume – Device only | 30 ml                                                                                                                          |
| Pressure drop @ 300 ml/min          | 5 mm Hg                                                                                                                        |
| Air Handling                        | <ul style="list-style-type: none"> <li>- integrated Bubble trap</li> <li>- 150 µm filter screen</li> </ul>                     |
| Housing Material                    | Polycarbonate                                                                                                                  |
| Max Blood Flow                      | 2500 ml/min                                                                                                                    |

### Order Guide

| Item Number | Product Designation                     | Units per box |
|-------------|-----------------------------------------|---------------|
| 095808      | CSC 14 Cardioplegia Set 1:1             | 10            |
| C20173      | CSC 14 Cardioplegia Set 4:1             | 5             |
| C20174      | CSC 14 Cardioplegia Set 4:1 with Shunt  | 5             |
| C20175      | CSC 14 Cardioplegia Set 4:1 (pediatric) | 5             |
| C20176      | CSC 14 Cardioplegia Set 1:1 (pediatric) | 5             |
| 050137      | HSC Holder                              | 5             |
| P3740       | CSC 14 sterile stand alone              | 5             |

## > BCD Vanguard™ *Efficiency, Safety and Convenience*



### Efficiency

The BCD Vanguard™ Heat Exchanger incorporates a chevron-grooved, closely packed, pleated stainless steel sheet that enhances mixing without hemolytic turbulence.

Thanks to the limited sheet and blood film thickness, the heat transfer is highly efficient, making hypothermic arrest and cardioplegic rewarming extremely rapid.

### Safety

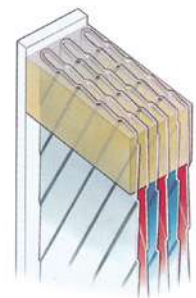
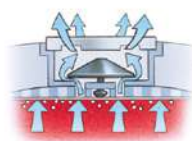
Safety is strongly emphasized throughout the design of the BCD Vanguard™ heat exchanger. Its pressure relief valve prevents rupture if a table line is inadvertently clamped, helping protect both the device and the patient.

The device has a bubble trap that includes a filter screen to deflect bubbles up to the membrane, which then vents the air out of the system.

### Convenience

The hydrophobic membrane of the BCD Vanguard™ makes priming more convenient without any extra steps.

By clamping the outlet line and turning on the pump, the air is automatically purged out of the device via the membrane. This unique feature reduces unnecessary delays.

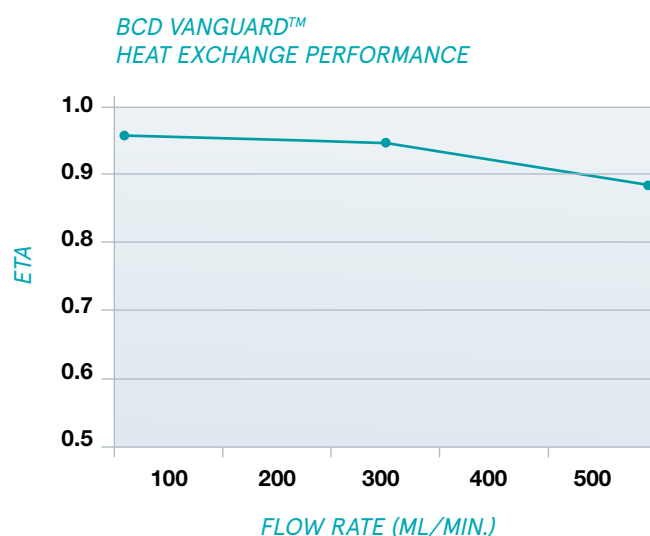


**Cardiopulmonary Bypass patients may also benefit from tip-to-tip  
Phosphorylcholine Coating**

**P.H.I.S.I.O.**  
PHosphorylcholine Inert Surface



P.H.I.S.I.O. coated Vanguard™ blood cardioplegia sets project patients decreases blood activation to patients heart during cardioplegia perfusion.



### Technical Features

|                                     |                                                                                                                                                          |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Connections                         | <ul style="list-style-type: none"> <li>- 1/4" Blood inlet</li> <li>- 3/16" Blood Outlet</li> <li>- 1/2" Hansen Quick Connectors (water ports)</li> </ul> |
| Static Priming Volume – Device only | 39 ml                                                                                                                                                    |
| Pressure drop @ 250 ml/min          | <10 mm Hg                                                                                                                                                |
| Air Handling                        | <ul style="list-style-type: none"> <li>- integrated Bubble trap</li> <li>- 105 µm filter screen</li> </ul>                                               |
| Housing Material                    | Polycarbonate                                                                                                                                            |
| Max Blood Flow                      | 500 ml/min                                                                                                                                               |

### Order Guide

| Item Number | Product Designation                             | Units per box |
|-------------|-------------------------------------------------|---------------|
| 05471       | D921 BCD Vanguard 1:1 Cardioplegia Set          | 5             |
| 05472       | D924 Vanguard 4:1 Cardioplegia Set              | 5             |
| 05473       | D924S Vanguard 4:1 Cardioplegia Set with shunt  | 5             |
| 05474       | D924P Vanguard 4:1 Cardioplegia Set pediatric   | 5             |
| 05475       | D928S Vanguard 8:1 Cardioplegia Set with shunt  | 5             |
| C21243      | Fully coated BCD Vanguard™ 4:1 Cardioplegia Set | 5             |
| 050137      | HSC holder                                      |               |

[www.livanova.com](http://www.livanova.com)



The Sorin Group Italia Quality System complies with:  
EN ISO 13485:2012

**CE** 0123 According to Annex II (Full Quality System) of  
MDD 93/42/EEC as amended by directive 2007/47/EEC



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